One Minute Weather

A Newsletter for ASOS Users

Volume 2, Spring 1996 (f)

Drops in the Bucket

We are beginning to have the kind of impact that we hoped for. We are getting some hard hitting "Letters to the Editor" and some compliments on the newsletter and the Toolboxes. We also are getting good technical articles. We are making progress toward customizing different editions for our major user groups—NWS, FAA, airport personnel, and climate people.

As managing editor, it is my job to foster thorough discussion of the strengths and weaknesses, the uses and abuses of ASOS. The letter from Mr. Sardinha makes many points worth discussing. Some of these issues remain problems, some have or soon will be addressed, and others fall into differences of opinion. Vickie Nadolski, ASOS Program Manager, responded to Mr Sardinha.

Mr. Mann, in his letter from Batten Airport, points to frustrations felt at a number of FAA-sponsored sites. In his response, Steve Imbembo, FAA ASOS Project Manager, explains commissioning difficulties facing the FAA.

To make this newsletter as useful as possible, we would like to hear from anyone who has something of interest to say to one or more of these groups, including suggestions for articles. Thanks for helping.

John Ball, Managing Editor

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Dear Editor:

Living in Commissioning Limbo

The following letter is from N. David Mann, Vice President and General Manager, Batten Airport.

I very much appreciated the editions of *One Minute Weather* and *Tool Box*. They each present some good information. Batten Airport is a privately owned, public use, transport category reliever airport in Racine, WI.

Several years ago the management and customers of Batten Airport were elated when we were chosen to receive an ASOS. We have a large volume of corporate and business traffic and four air taxi operators on the field.

We were even more elated when the assembly started, and we had a completion date for the installation. It was great when we could dial the system on the phone and listen to it.

Now it is two and a half years later, and it is still not legal to use. It doesn't transmit over a radio. You cannot view it in operations. But you can dial it up and listen to the test program. All the pilots here think it's a joke. It appears the system is going to be worn out and obsolete before it has ever been used once.

What can I do? Do I beg NWS for help? Do I try to cancel the land lease and go buy an AWOS-III? My customers badly need this system, and I need your help. ❐

Communications Gap

Steve Imbembo, FAA ASOS Project Manager, 202/267-8668 responds.

The FAA continues to experience a number of problems that are contributing to significant delays in commissioning FAA-sponsored ASOS systems.

The main problem is the need for long-line communica-

tions from the local ASOS equipment to the FAA Weather Message Switching Center in Atlanta.

The FAA will employ its own communications network for its ASOS units, which it is implementing. Because it is a new network, there have been a number of "growing pains" associated with this effort. Many FAA sites

" Most of the delays are due to lack of staff and funding."

are experiencing delays getting the communications installed or making final connections. Most of the delays are due to lack of staff and funding.

The long-line communication of ASOS information is a requirement for commissioning. It permits the weather observations from ASOS to be transmitted over the national weather networks. This link also enables the NWS to remotely examine each observation for missing data and system maintenance indicators.

Once the long-line communications are operating reliably, NWS evaluates the system (the NWS is responsible for commissioning the ASOS) to ensure it works properly. This test normally takes 60 to 75 days. Abnormalities, if any, are corrected. Serious deficiencies may cause delays in commissioning. They include:

- **Ground-to-Air (GTA) Radio Frequency Interference Problems:** Some sites have problems with radio antenna location, grounding, or interference with wide-band navigational aids, such as unicoms. These problems must be corrected or a waiver granted if there are no major impacts affecting commissioning.
- **Location of sensors:** In some cases, the ASOS sensors must be relocated, for optimal operation, delaying commissionings.
- **Maintenance Accessibility:** Some of the ASOS sites are difficult for NWS maintenance personnel to access. Road accessibility and siting of GTA antennas can be real problems. These sorts of problems may require the construction of access roads, relocating antennas, and other actions that commonly delay commissioning of the ASOS system.

The FAA and NWS are trying to expedite the commissioning process. We recognize that the benefits of ASOS cannot be obtained until the systems are officially a part of the National Airspace System. We greatly appreciate the patience of the user community while the Government irons out these troublesome commissioning issues. ❐

Dear Editor:

Stop Killing Climatic Records

The following letter was sent by August J. Sardinha, Jr., Lead Forecaster, NWSFO Gray, ME.

ASOS is the albatross of the NWS modernization. ASOS is destroying climatic records faster than the devastation of the world's rain forests. ASOS should be totally unacceptable at all First Order Stations with long standing climatic records. These records are a public trust and treasure.

Portland, ME, has witnessed severe losses of climatic data with more to come. Listed below are but a few of the facts that a station with a non-commissioned ASOS should expect after commissioning occurs.

Fact: Portland's ASOS was commissioned on August 1, 1994,

"ASOS is turning a public treasure into a public embarrassment and public disgrace for the NWS."

immediately ending more than 1.1 million hours of continuous sky cover conditions.

Fact: Portland's 102 years of sunshine records ended on September 30, 1995. The sensor is

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being moved to NWSFO Gray, ME, as sunshine is not a responsibility of the private contractor.

Fact: Portland's 114 years of snowfall records are in jeopardy, as by original contract, the private augmenters do not have to take any type of snowfall measurements or water equivalents.

Fact: Portland's 125 years of precipitation records are also in jeopardy as Portland's tipping bucket does not work in any season.

Documented example: On September 23, 1994, Portland received 4.18 inches of rain; the ASOS tipping bucket recorded 1.18 inches. What's even worse is that NCDC left the total blank in the daily precipitation column for September 23, 1994.

Documented example: From the blizzard of March 1993, Portland measured 18.6 inches of snow with a water equivalent of 1.58 inches, while the ASOS tipping bucket registered it as a "trace" event. Yet we were told that ASOS did a terrific job during the blizzard.

Fact: ASOS automatically tabulates the average daily wind speed at the end of every day. From the same data, NCDC comes up with a different value for nearly each day. The daily difference can be off by one mile per hour or more. Which value is correct? The local and NCDC daily averages agree only 25% of the time.

On December 15, 1994, a group representing NWS and Regional Headquarters paid a visit to NWSFO Gray to answer and/or solve our genuine concerns of a standalone ASOS, especially during the late fall and early spring. These are Portland's seasons for one or a combination of liquid, freezing, and frozen precipitation, which ASOS cannot see or cannot define.

Also at this meeting, the discrepancies in the local and NCDC published monthly LCDs and other conflicting data were cited. The visitors were unaware of this problem and said they would give us a reply concerning the LCD discrepancies. We have not received a response, and the monthly discrepancies continue.

ASOS is turning a public treasure into a public embarrassment and public disgrace for the NWS. We in the trenches have to deal with the wrath of the lawyers, insurance companies, other government agencies as well as the general populous due to the numerous inabilities of ASOS. The big kicker comes this winter when the people who have a need to know ask how much snow has fallen, and we will have to tell them we do not know—due to ASOS and its inabilities. ❐

Growing, Improving

Response from Vickie Nadolski, ASOS Program Manager.

I appreciate the concerns of Mr. Sardinha, and I am sure that many share the same concerns.

More than a decade ago, NWS began designing and planning for modernization. ASOS is one part in that modernization, one with a major potential impact on climatological records. Yes, the NWS is changing, and there is no question that climatological records are changing as well.

ASOS is only one source of observational data in the United States. Additional data are available from other sources to support aviation and other applications. Taken together, these data constitute the Total Surface Observation. The Total Surface Observation concept envisions data from complementary and supplementary components as well as the ASOS.

The complementary technology consists of data derived from other observing technologies including satellite, radar, and the lightning detection network.

"ASOS automation is allowing the NWS to move away from airports and to make better use of valuable human resources."

Because some weather parameters observed manually today will not initially be observed by ASOS, NWS is introducing two new classes of supplementary observations to the current array of meteorological observations: Supplementary Data Observations (SDOs), event driven data; and Supplementary Climate Observations (SCDs). Both observations are routinely schedand useful for climatological applications and hydrometeorological operations.

Originating from the WFOs, SDO and SCD observations are not appended to the ASOS observation. Instead, they are sent as separate messages through NWS

communications systems, the Family of Services, NOAA Weather Wire, and commercial vendors. These observations include daily maximum and minimum temperatures, daily total (minutes of) sunshine, frozen water equivalent, cloud types, snow increase, and snow depth.

We will also continue to have surface observational data in the ASOS era from more than 20,000 automatic and manual hydrometeorological sites, including cooperative and hydrological networks. In the future, NWS will use local Mesonets, subject to them meeting NWS standards, for instrumentation and siting.

ASOS automation is allowing the NWS to move away from airports and make better use of valuable human resources. ASOS has increased the size of the data network for a selected suite of weather elements, but this also means that some of the previously recorded data will no longer be available for certain sites.

NWSH staff is working closely with NCDC to provide the best possible climate data and to preserve records *where NWS still has staff*. We will continue to work with NCDC to refine the LCD and minimize ASOS errors.

Because ASOS was designed with a tipping bucket for liquid accumulation, universal weighing gauges have been installed at WFOs to provide more data. If a universal gauge is available for an LCD site with an ASOS, NCDC publishes the universal data as an appendix to the LCD.

Climate studies, funded and supported by ASOS, compare ASOS instrumentation to pre-ASOS equipment. The Climate Data Continuity Study, showed that ASOS temperatures were more accurate than those of the NWS standard HO-83. (See story, Page 4)

The ASOS Program Office is developing two new sensors: a frozen water equivalent sensor and a sunshine sensor. Look for implementation once we complete development and testing in the next few years.

The ASOS Program Office has issued a Product Improvement Development Plan that describes the development effort for the next three to five years. Contact the managing editor for a copy. ❐

Climate Data Continuity Study Comparison Sites for Daily Maximum and Minimum Temperatures

Number	Site ID	Station Name
1.	AMA	Amarillo, TX
2.	AST	Astoria, OR
3.	BRO	Brownsville, TX
4.	BTR	Baton Rouge, LA
5.	COS	Colorado Springs, CO
6.	DDC	Dodge City, KS
7.	GLD	Goodland, KS
8.	GRI	Grand Island, NE
9.	ICT	Wichita, KS
10.	LNK	Lincoln, NE
11.	OKC	Oklahoma City, OK
12.	PWM*	Portland, ME
13.	SYR	Syracuse, NY
14.	TOP	Topeka, KS
15.	TUL	Tulsa, OK

* Station commissioned in August, 1994

Climate Data Continuity Project Ends

Update as of 10/95

Two sets of stations are included in the Climate Data Continuity Project (CDCP). The CDCP studies temperature and humidity comparisons of the ASOS hygrothermometer and the HO-83.

One set, listed in the table above, will be used to compare daily maximum and minimum, six-hourly and dewpoint temperatures from June 1, 1994 through August 31, 1995.

The second set will include additional sites broadly distributed across the U.S. Results from the first set of 15 sites are now available for the first 12-month period—June 1, 1994, through May 31, 1995. Preliminary findings include the following:

- No temperature bias exists between ASOS and a calibrated field standard.
- The HO-83 has a warm bias of approximately 0.5 degrees F deduced from co-located sites and temperature comparisons with high winds.
- The HO-83 is affected by solar heating deduced from co-located sites.
- Local effects due to changes in instrument location are key.
- ASOS is cooler than the HO-83, on average, at 15 locations by approximately 1.1 degrees F in maximum temperature and 0.8 degrees F in minimum temperature.
- ASOS relative humidities are 0% to 3% lower than the HO-83 due to cooler air tem-

perature and similar dewpoint temperature.

The CDCP study is managed in the NWS by Andy Horvitz and is conducted by Thomas McKee, Nolan Doesken, and John Kleist at Colorado State University and by Norman Canfield at the University of Maryland. For more information, contact Thomas McKee at 303/491-8545. ❐

Aviation Demo Project Concludes

The joint NWS and FAA ASOS Aviation Demonstration concluded on August 15, 1995.

The Demonstration Project measured the ability of the ASOS system to provide accurate, timely surface weather observations for aviation.

At the Demonstration's 22 commissioned sites, NWS observers reviewed each element of the ASOS observations. ASOS observations that did not represent perceived weather conditions were reported in an Observer's Log.

Based on these logs, representativeness exceeded 98%. Additionally, a separate minute-by-minute comparison was conducted between "untouched" ASOS and manual observations at three non-commissioned sites. This comparison yielded comparability statistics of 96% for visibility and 80% for ceiling.

Engineering performance also was analyzed. Individual sensor availability, system availability, and long-line communications availability exceeded 99%. While mean time between missing sensor events was lower than desired, the duration of each event was sufficiently short to provide high system availability.

A final Demonstration Report is in preparation. For a copy, please write to Marty Deiseroth, Demonstration Project Manager, ASOS Program Office, 8455 Colesville Road, Suite 705, Silver Spring, Maryland, 20910. ❐

On the Internet

If you like your information electronically, visit the NWS Home Page for ASOS and other NWS updates. To tap in, go to http://www.nws.noaa.gov. ❐

Field Perspective

New Paper Released

Victor S. Passetti, NWS, Cleveland, OH, recently wrote an Eastern Region Technical Attachment evaluating ASOS performance. The paper is entitled "A Short-term Evaluation of the Automated Surface Observing System at Cleveland, Ohio."

For a copy of this article, write to the managing editor at the address on Page 2. ❐

OID Command Phone Procedures

At the ASOS Operations and Monitoring Center (AOMC), it has become apparent that field observers are having problems answering the ASOS command phone. Below is an easy step-by-step procedure for using ASOS command phones.

1. If you see "YOU ARE BEING CALLED BY OID #4" flashing in yellow in the lower left-hand corner of your OID, the party on OID #4 is trying to contact you. Press EXIT (Key 1) to return to the first level of the 1-minute screen.
2. Once back at the 1-minute screen, press CMD (Key 9).

PRINT	GENOB	CMD
REVUE	TWR	
SIGN	EDIT	AUX

3. Press PHONE (Key 4).

COMMANDS

OBS		
PHONE		
EXIT		TIME

4. Press ANSWR (Key 6).

		HANG
		ANSWR
EXIT	BACK	CALL

5. You can now type in any message you want to send and the system will display it at the other OID. When the session is over, press EXIT (Key 1) or ABORT (Key 6) to return to what you were doing.

		ABORT
EXIT	BACK	

For more information on this topic, refer to *Automated Surface Observing System Ready Reference Guide*, Section 3.23.2, Page 60, Answering a Call From an OID.

For copies of pertinent sections of the ASOS Ready Reference Guide, call 800/331-6476.

For further questions regarding the OID command phone procedures, call the AOMC at 800/242-8194. ❐

What's Up Doc?

An Explanation of Precipitation Accumulation Remarks

Recently, we have received several questions concerning how we calculate the precipitation accumulation remarks (PCPN rrrr), additive data groups (6RRR/ and $7R_{24}R_{24}R_{24}R_{24}$), and daily total (24 HR PRECIPITATION).

It is true that the ASOS daily precipitation total, 6RRR/ and $7R_{24}R_{24}R_{24}R_{24}$ groups, and hourly PCPN rrrr remarks may not agree. The discrepancies encountered are due largely to the reporting period each total represents.

It is also true that if the 1-minute precipitation totals stored in the 12-hour engineering data are summed for the period in question, that the 6RRR/ and $7R_{24}R_{24}R_{24}R_{24}$ groups may be incorrect. These incorrect totals are due to a software error.

The ASOS Program Office is aware of this error and has submitted an Operational Trouble Report to correct the problem in a future software load.

The PCPN rrrr, 6RRR/ and $7R_{24}R_{24}R_{24}R_{24}$ groups are updated each minute, but are displayed only when an observation is pending.

Keep in mind that the 6RRR/ group is only displayed during the edit time of the 3- and 6-hourly observations, and when precipitation has occurred during the period. The $7R_{24}R_{24}R_{24}R_{24}$ group is displayed in the 12 UTC observation when more than a trace of precipitation has been detected by ASOS during the previous 24 hours.

The table below lists the ASOS precipitation reporting groups and their reporting periods. The table assumes a site with an SAO hourly report time of 50 minutes past the hour, a 5 minute edit time, and an hourly SAO transmit time of 55 minutes past the hour. The ASOS screen showing your site's setup can be found by pressing the following function keys from the 1-minute screen: REVUE-SITE- PHYS.

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Precip. Group	Accumulation Time Period	Update Frequency	Notes
Daily Summary	0001 LST - 0000 LST	Each Minute	
PCPN rrrr	H_i:57 - Hh_{i+1}:56[1]	Each Minute	
6RRR/	HH_i:57 - Hh_{i+2}:55[2] Hh_i:57 - Hh_{i+5}:55	Each Minute	3-Hourly SAO 6-Hourly SAO
$7R_{24}R_{24}R_{24}R_{24}$	HH_i:57 - Hh_{i+24}:55[3]		24 Hour Amount Reported at 12Z

1 - Since this is an hourly remark "i" could equal 0 through 23, e.g., 0:57 through 1:56 is the accumulation time period for the 1:56 UTC observation.

2 - This remark is encoded at 3- and 6-hourly intervals. Therefore "i" could equal 0, 2, 5, 8, 11, 14, 17, 20, and 23, e.g., the accumulation period for the 2:56 UTC observation is 0:57 through 2:55.

3 - This group reports a 24-hour accumulation at 12 UTC. The accumulation time period is from 11:57 UTC through 11:55 UTC on the following day.

Commissioning Numbers Up

As of February 20, 1996, the NWS and FAA have commissioned 188 ASOS systems at NWS and FAA-sponsored sites.

For more information, contact Stephen Imbembo, FAA contact person, 202/267-8668. At the NWS, contact MAR Commissioning Manager Joe Facundo at 301/713-0070. ❐

Sensor of the Season

Freezing Rain Comes to ASOS

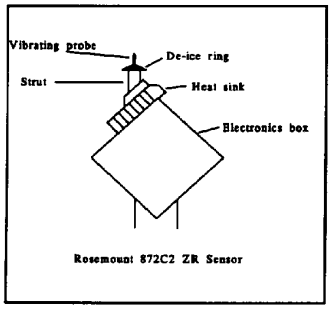
This paper is a condensed version of a presentation made at the Mt. Washington Observatory's "FOCUS 2000: Wind, Ice, and Snow" Conference, June 1995. For the full paper, contact the ASOS Program Office. Direct questions or comments to Hughes STX Corporation, ATTN: Al Ramsay, 43872 Weather Service Road, Sterling, VA 20166, 703/260-0341, or aramsay@ccmail.stx.com.

How Does it Work?

Since the late 1980s, the NWS has been evaluating a new sensor to report freezing rain. The technology has a long and successful history as an aircraft ice detector. After going through several modifications in the early 1990s, the sensor performed so well in the winter of 1994-1995 that NWS decided to deploy it on the ASOS.

This article will give you a picture of how it works, how well it works, and where it may have problems in detecting and reporting icing conditions.

The new sensor, Rosemount Aerospace Corporation's Model 872C2, detects ice accumulation by monitoring the resonant frequency (nominally 40,000 hertz) of a vibrating magnetostrictive metal tube. The tube is made of a special metal alloy in which the atoms actually elongate when subjected to a magnetic field ("magnetostriction"); the tube is subjected to an oscillating electromagnetic field, and special circuits determine the natural resonant frequency of the tube, which depends on the amount of mass made to vibrate.



Rosemount 872C2 ZR Sensor

The resonant frequency decreases with increasing accretion of ice, frost, or wet snow. The sensor's de-icing system is activated by the ASOS algorithm when ice, frost, or wet snow drive the frequency below a certain value. The sensor is de-iced through internal heating elements, which heat the probe and strut above the boiling point of water for a short time. Frequency values are reported to the ASOS once each minute. The system combines information from the sensor with data from other ASOS sensors to generate the required reports of freezing rain. The ASOS does not report data that indicate the presence of icing *without detectable precipitation.*

A **"sensor" event** begins (or continues after a de-ice) when the vibration frequency shows 0.005 inches of ice accretion and the rate of frequency decrease exceeds about 0.002 inches in 15 minutes. The event ends whenever the frequency indicates an equivalent of less than 0.005" of ice or whenever the rate of ice accretion is less than about 0.002" in 15 minutes. A **"system" freezing rain event** is reported from the ASOS only after combining the sensor output with data from the ASOS precipitation identifier.

The Light Emitting Diode Weather Identifier (LEDWI) is an optical sensor that reports precipitation falling through its sensing volume. It is able to discriminate between rain and snow. The LEDWI *must* provide a positive indication of precipitation ("P" or "R") before ASOS can transmit a report of freezing rain. This algorithm protects the ASOS from falsely reporting rime icing as freezing rain but results in the loss of 0.6% of true freezing rain minutes when precipitation is too light to be detected by the LEDWI (less than about 0.01" per hour).

If the LEDWI is reporting snow (S), any output from the freezing rain sensor will be *overridden*, and the ASOS will report snow. This algorithm protects the ASOS from falsely reporting wet snow as freezing rain, but results in the loss of 2.3% of true freezing rain minutes when the freezing rain is mixed with snow.

How Much Will It Catch?

A measure of ASOS's ability to detect freezing rain is provided by the *number of minutes* in

which both ASOS and an observer reported freezing rain. During the 1994-1995 test, observers reported 11,318 minutes of freezing rain; ASOS reported 12,234 minutes.

Although the total numbers of minutes are close (and have been over the last three testing seasons), researchers noted that ASOS and humans do not necessarily report freezing rain at the same time. The number of *coincident* minutes was 7,428, or about **66 percent** of human minutes. Summarized here are detailed analyses of 3,890 minutes of unreported freezing precipitation:

A significant, but indeterminate, fraction of the minutes lost to slow or no accretion are attributed to three causes:

- Micrometeorological differences related to the separation between observers and the ASOS installations: It is possible, especially at temperatures near freezing, to have reportable freezing rain at one location but not at another a few thousand feet away.
- Limitations imposed by "Basic Weather Watch" observing procedures, which do not require continuous monitoring of the weather. Under these procedures, observers may be understandably conservative in their reporting of hazardous situations and may continue to report freezing precipitation until they are relatively certain that an event has ended and is unlikely to resume.
- A difference in the response of objects to slow changes in temperature. The thermal mass of the 872C2 sensor is known to cause delays in the onset and cessation of icing relative to thin (and highly responsive) aluminum strips as the temperature slowly falls below or rises above the freezing point. (Consider the delays possible on the cold-soaked wing of a 747.)

Unreported Freezing Rain Minutes	
CAUSE	**# MINUTES (% OF ALL ZR MINUTES)**
Unknown (ASOS 1-minute data were not available)	330 (2.9%)
Slow Recovery from De-ice	204 (1.8%)
Clamping (Incr in Freq Caused by Ice Accumulating at Base of Probe)	178 (1.6%)
Snow Override	258 (2.3%)
LEDWI Unable to Detect Precip	67 (0.6%)
Slow or No Accretion	2853 (25.2%)

Will it Lie to Me?

Researchers found that, of the 12,234 minutes of freezing rain reported by the ASOS, 9,771 minutes (80%) were confirmed by an observer as having either freezing rain or freezing drizzle in progress.

An additional 467 minutes (4%) were reported during ice pellets accreting on surfaces, but which did not technically constitute a "freezing rain" condition. We can call 67 minutes (0.5%) true false alarms, directly attributable to wet snow accreting on the probe, briefly misidentified as "R" or "P" by the ASOS weather identifier, and therefore erroneously reported as freezing rain.

The remaining 1,929 unverified ASOS freezing rain minutes are believed to have occurred in three conditions:

- At temperatures near freezing where local conditions could have existed at an ASOS but not at an observer's location
- Immediately preceding observer reports of freezing rain when the observer's Basic Weather Watch procedures did not pick up the start of an event
- At the end of an event when the 872C2's thermal mass caused the sensor to continue to accrete ice after the ambient temperature warmed above freezing.

Including the 12,234 icing minutes actually reported by the ASOS as freezing rain, the 872C2 sensor responded to more than 68,000 minutes of icing from all sources. (See table below.)

What's Happening?

Testing in 1994-'95 indicated that the combination of the 872C2 ice detector and the Light-

Icing Detected from All Sources, 1994-1995	
CATEGORY	MINUTES
Freezing Rain	12234
"False" Freezing Rain: Rime or Hoarfrost with High Accretion Rate *(Not Transmitted by ASOS)*	13557
Wet Snow *(Not Transmitted by ASOS)*	1276
Rime or Hoarfrost with Low Accretion Rate *(Not Transmitted by ASOS)*	> 40000
TOTAL	**> 68000**

Emitting Diode Weather Identifier effectively allows ASOS to identify periods of freezing rain, with few false alarms.

More than 300 sensors will be installed at NWS, FAA and Navy sites in the United States in 1996-1997. Although this ASOS data might be able to differentiate among glaze, rime, frost and wet snow, neither the NWS nor the FAA sees a need to provide this information and have planned no formal development activities.

For more information, contact the managing editor at the address on Page 2. ❐

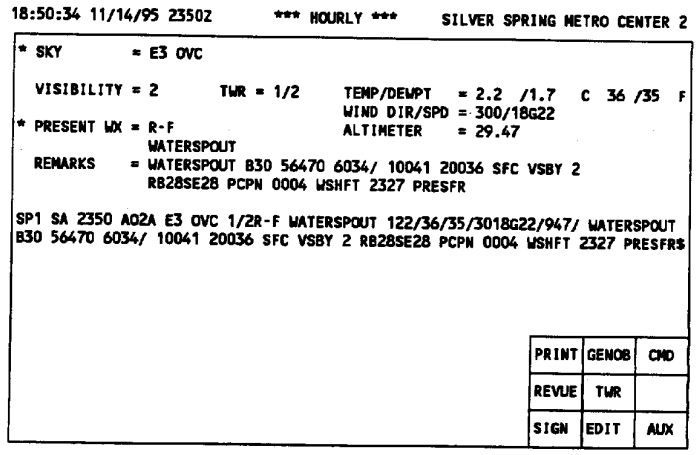


Figure 1: ASOS 1-minute screen with a pending hourly observation containing urgent special, 3- and 6-hourly additive data, and automated remarks. This screen is from software version 2.30.

Controlling Surface Aviation Observation Remarks

The ASOS Program Office has received questions about the remarks section of the Surface Aviation Observation (SAO). Sometimes we hear reports that ASOS sent out a 6-hourly observation without a pressure tendency and change group (5appp), or that the precipitation groups (6RRR/, $7R_{24}R_{24}R_{24}R_{24}$ PCPN rrrr) were not encoded. The software that generates the remarks section of the SAO is straightforward. We can explain these seemingly mysterious occurrences. There are four parts to the remarks section:

- Urgent Special Remarks (e.g., TORNADO B25)
- Manual Remarks
- 3- and 6-Hourly Additive Data (e.g., 56470 6034/10041 20036)
- Automated Remarks (e.g., RB28SE28 PCPN 0004 WSHFT 2327 PRESFR).

The observer has the ability to control the content of the remarks section by using the EDIT function from the 1-minute screen. (See Figure 1.)

Remarks can be controlled through the "edit remarks" function. When you use the EDIT and REM functions from the 1-minute screen, the system will display the screen in Figure 2. The OBS REMARK field displays all of the remarks that will be contained in the observation. Urgent Special (USP) remarks are displayed in the TORNADIC REMARK field, manual remarks in the MANUAL REMARK

```
18:51:06 11/14/95 2351Z 4 MIN 15 SEC LEFT TO EDIT SILVER SPRING METRO CENTER 2

OBS             WATERSPOUT B30 56470 6034/ 10041 20036 SFC VSBY 2
REMARK          RB28SE28 PCPN 0004 WSHFT 2327 PRESFR

TORNADIC        WATERSPOUT B30
REMARK

MANUAL
REMARK

AUTO REMARK
  RVR           ON
  PREWX         ON   RB28SE28
  PRECIP        ON   6034/ PCPN 0004
  SNOW          ON
  WIND          ON   WSHFT 2327
  TEMP          ON   10041 20036
  VISIBILITY    ON
  SKY           ON
  PRESSURE      ON   56470 PRESFR

                                  REMARKS EDIT
                              PRINT | TORN | PREV
                              SEQN  |  MAN | ABORT
                              EXIT  | BACK | NEXT
```

Figure 2: ASOS REMARKS EDIT screen. All SAO remarks can be controlled by using the functions found on this screen.

area. The AUTO REMARK section at the bottom of the screen is where both the 3- and 6-hourly additive data and automated remarks are controlled.

When displaying the REMARKS EDIT screen (Figure 2), the ON/OFF designation for the first AUTO REMARK (in this case RVR) will be highlighted.

It is only possible to turn the automated remarks on or off; it is not possible to edit them. To turn the automated remarks for pressure off, use the **PREV/ NEXT** functions, or up and down cursor keys, to move the highlighted block to PRESSURE, then use the **SEQN** (sequence) function to turn the automated remarks off. The SEQN function is a toggle to turn the remarks on and off.

When pressure is toggled off, the system removes from the observation ***all*** automated remarks for pressure, including 3-hourly additive data.

To restore these remarks, use the SEQN function to turn the remarks on. In Figure 2, when

```
18:51:00 11/14/95 2351Z 4 MIN 9 SEC LEFT TO EDIT SILVER SPRING METRO CENTER 2

OBS             WATERSPOUT B30 6034/ 10041 20036 SFC VSBY 2
REMARK           RB28SE28 PCPN 0004 WSHFT 2327

TORNADIC        WATERSPOUT B30
REMARK

MANUAL
REMARK

AUTO REMARK
  RVR           ON
  PREWX         ON   RB28SE28
  PRECIP        ON   6034/ PCPN 0004
  SNOW          ON
  WIND          ON   WSHFT 2327
  TEMP          ON   10041 20036
  VISIBILITY    ON
  SKY           ON
  PRESSURE      OFF

                                  REMARKS EDIT
                              PRINT | TORN | PREV
                              SEQN  |  MAN | ABORT
                              EXIT  | BACK | NEXT
```

Figure 3: Automated remarks for PRESSURE have been turned off by using the sequence (SEQN) function. It is possible to turn on the remarks to see which remarks ASOS would have encoded. This would be useful for entering the 3- and 6-hourly additive data (e.g., 56470) in the MANUAL REMARK field when deleting an incorrect pressure falling rapidly remark (PRESFR). Note that the OBS REMARK field has been updated to reflect the change in the AUTO REMARK area.

pressure remarks are turned off, the 56470 PRESFR remarks are removed from the observation. (Figure 3) Therefore, if the observer does not agree with the PRESFR remark, his or her only option is to remove this remark by sequencing off the automated remarks for pressure.

The observer will need to keep in mind that this will also remove the 3-hourly pressure data (56470). To correct the situation, the observer would have to use the MANUAL REMARK section to edit in the 56470 group.

Each set of automated remarks works the same way. For example, if the observer does not agree with the current hourly accumulation of precipitation (PCPN 0004), he or she will have to sequence off the PRECIP remarks and then edit in (through manual remarks) the precipitation groups to include in the observation.

"After the hourly observation (SA/RS) has been transmit-

ted, all the automated remark fields, even pressure remarks, are automatically toggled back on."

To enter remarks in the MANUAL REMARK field, use the MAN function on the REMARKS EDIT screen to enter required data in the observation. (Figure 4.)

When the observer makes an entry in the MANUAL REMARK area, it is encoded immediately after the TORNADIC REMARK information in the SAO. The order of remarks in the SAO is:

- TORNADIC REMARK
- MANUAL REMARK
- 3- and 6-Hourly Additive Data
- Automated Remarks.

Therefore, when an observer turns off incorrect data in an AUTO REMARK and enters correct data/information in the MANUAL REMARK field, the usual order of the remarks will appear to be incorrect (e.g., a manually entered 6RRR/ group would appear before an automated 5appp group).

In Figure 4, the remarks 5APPP 6RRR/ 1TTTT 2TTTT were entered in the MANUAL REMARK field. When the observer manually enters data in remarks, the observer must ensure that conflicting information is not transmitted in the observation.

There have been many cases where more than one 6RRR/ group was encoded in a transmitted observation. This can be avoided by ensuring that the necessary AUTO REMARKs are sequenced off as shown in Figure 5.

```
18:54:07 11/14/95 2354Z 1 MIN 14 SEC LEFT TO EDIT SILVER SPRING METRO CNTR 2

OBS              WATERSPOUT B30 5APPP 6RRR/ 1TTTT 2TTTT 6034/
REMARK           10041 20036 SFC VSBY 2 RB28SE28 PCPN 0004 WSHFT
                 2327

TORNADIC         WATERSPOUT B30
REMARK

MANUAL           5APPP 6RRR/ 1TTTT 2TTTT
REMARK

AUTO REMARK
  RVR        ON
  PREWX      ON   RB28SE28
  PRECIP     ON   6034/ PCPN 0004
  SNOW       ON                          REMARKS EDIT
  WIND       ON   WSHFT 2327
  TEMP       ON   10041 20036          | PRINT | TORN | PREV |
  VISIBILITY ON                        | SEQN  | MAN  | ABORT |
  SKY        ON                        | EXIT  | BACK | NEXT |
  PRESSURE   OFF
```

Figure 4: Use the MAN (manual) function on the REMARKS EDIT screen to enter remarks. The observer is responsible for encoding each remark in its proper format and for removing any AUTO REMARK that contradicts the manual remarks. Note that the OBS REMARK field has been update with the manual entries.

```
18:55:07 11/14/95 2354Z 0 MIN 14 SEC LEFT TO EDIT SILVER SPRING METRO CENTER 2

OBS              WATERSPOUT B30 5APPP 6RRR/ 1TTTT 2TTTT PCPN rrrr
REMARK           SFC VSBY 2 RB28SE28 WSHFT 2327

TORNADIC         WATERSPOUT B30
REMARK

MANUAL           5APPP 6RRR/ 1TTTT 2TTTT PCPN rrrr
REMARK

AUTO REMARK
  RVR        ON
  PREWX      ON   RB28SE28
  PRECIP     OFF
  SNOW       ON                          REMARKS EDIT
  WIND       ON   WSHFT 2327
  TEMP       OFF                       | PRINT | TORN | PREV |
  VISIBILITY ON                        | SEQN  | MAN  | ABORT |
  SKY        ON                        | EXIT  | BACK | NEXT |
  PRESSURE   OFF
```

Figure 5: The necessary AUTO REMARK fields have been sequenced off so that conflicting information would not be transmitted in the SAO. After the SA/RS is transmitted, the system will automatically sequence these fields to the on position and cear the MANUAL REMARK field.

The observer needs to keep in mind that after the routine hourly observation (SA/RS) is transmitted, ASOS will automatically clear all entries in the MANUAL REMARK section and sequence on all the AUTO REMARK fields. ❐

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